DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ARITHMETIC.

120. Proposed by ELMER SCHUYLER, B. Sc., Professor of German and Mathematics in Boys' High School, Reading, Pa.

How many balls 1 inch in diameter can be put in a cubical box 1 foot in the *clear* each way, putting in the maximum number? [From Greenleaf's *Treatise on Algebra.*]

II. Solution by J. M. ARNOLD, Crompton, R. I.

In regard to the solution of Problem 120, given in the January number, it seems to me that the total number of balls, 2147, is not the maximum number that can be placed in the box.

Suppose we pack it this way: Place 144 balls on the bottom, then a layer of 121, and so on alternately until fifteen layers have been put in.

Now fill with sawdust so that the sawdust is just level with the tops of the balls. We have left a clear space of 12×12 and a little more than 1 inch in depth. Into this space can be placed 150 balls, by first placing a row of 12 balls against one side of the box, then a row of 11, and so on alternately until thirteen rows are put in; making 7 rows of 12 and 6 of 11 balls each, 150 in all.

The distance between the center lines of the rows will be $\frac{1}{2}\sqrt{3}$.

And $12\times\frac{1}{2}\sqrt{3}+1=11.3923$. $12-11.3923=.6077$ inch to spare.

For the whole box we have:

Eight layers of 144 each	=1152
Seven layers of 121 each	= 847
One layer of	150
Total	=2149

124. Proposed by ALOIS F. KOVARIK, Instructor in Mathematics and Science, Decorah Institute, Decorah, Iowa.

At what time between 5 and 6 o'clock is the minute hand midway between 12 and the hour hand? When is the hour hand midway between 4 and the minute hand?

I. Solution by M. A. GRUBER, A. M., War Department, Washington, D. C.

Take a and $a+1$ as the hours between which the conditions are to happen.

Let x=the distance, after a o'clock, the minute hand must move.

Let $\frac{1}{12}x$=the distance the hour hand moves.

(1). The first question of the problem involves two positions.

(a). In the first position, we readily find $5a+\frac{1}{12}x=2x$.

$$\therefore x=\frac{60a}{23}.$$

(b). In the second position we find $5(12-a)-\frac{1}{12}x=2(60-x)$.

$$\therefore x=\frac{60(12+a)}{23}.$$